

Parasites of the Great Egret (*Ardea albus*) in Florida and a Review of the Helminths Reported for the Species

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ABSTRACT: Thirty-nine species of helminths (21 trematodes, 12 nematodes, 2 acanthocephalans, and 4 cestodes) were collected from 103 of 106 (97%) great egrets (*Ardea albus*) from Florida, 1987–1997. Infected birds harbored a mean of 6 helminths (range, 1–23). Twenty-eight species are new host records. The most prevalent helminths were trematodes of the genera *Posthodiplostomum* and *Aspicotyle* (represented by at least 4 species each) and the nematode *Contracaecum multipapillatum*. A review of the parasitic helminths reported from great egrets is also presented.

KEY WORDS: great egret, *Ardea albus*, Florida, helminths, trematodes, nematodes, acanthocephalans, cestodes, survey, prevalence, intensity.

Great egrets (*Ardea albus*, Ciconiiformes) range in the Americas from southern Canada to southern Chile and Argentina (American Ornithologists' Union, 1983). In southern Florida, great egrets nest colonially between January and May of each year, foraging on fish and invertebrates (Frederick et al., 1997). Although there is little information on movement and dispersion patterns of great egrets, there is some indication that this species does move considerable distances within the Americas. Lincoln (1939) reported movements of banded great egrets from Florida to South Carolina and from Mississippi to Canada, Colombia, Honduras, and El Salvador.

A list of the helminth species known to occur in great egrets is presented in Table 1. Most of the reports come from Latin America (Mexico, Brazil, Argentina, Colombia, Venezuela, and Cuba), with some information from the United States. None of these studies, however, represent complete parasite surveys. The objective of the present study was to conduct the first systematic survey of helminths in great egrets and to determine the prevalence, intensity, and abundance of infection by each helminth species.

Methods

One hundred six great egrets were collected from 1987 through 1997 from 9 counties in Florida (Okeechobee = 37 birds; Monroe = 25; Collier = 15; Dade = 11; Pinellas = 7; Broward = 5; Lee = 3; Palm Beach = 2; Hillsborough = 1). Based on body measurements (bill length and body weight) and plumage characteristics, birds were divided into 4 age categories: nestlings, fledglings, juveniles, and adults. The mean \pm SD (range) of bill length (cm) and body weight (g) for the 4 age categories were: 4.4 ± 2.1 (1.5–11.2) cm and 219 ± 179 (18.7–820) g for nestlings; 9.0 ± 0.5 (8.3–9.5) cm and 481 ± 17 (465–500) g for fledglings; 11.2 ± 0.7 (9.3–12.1) cm and 825 ± 166 (500–1,110) g for juveniles; and 11.6 ± 0.6 (10.5–12.2) cm and 887 ± 255 (620–1,240) g for adults. Dead nestlings and fledglings were collected during regular visits to breeding colonies (between February and July), and juveniles and adults were collected either as roadkills or from rehabilitation centers (year round). Birds from rehabilitation centers were included in the study only if they died soon after their arrival at the centers and if they did not receive any treatment while in captivity. The sample included a total of 82 nestlings (37 males, 34 females, and 11 of unknown gender), 4 fledglings (1 female and 3 males), 13 juveniles (6 females, 6 males, and 1 of unknown gender), and 7 adult males. In general, both captive and free-ranging birds were examined for the presence of parasites 24–48 hr after they died. Techniques for the necropsy of birds and for the collection, fixation, and staining of helminths were similar to those described by Kinsella and Forrester (1972). The terms prevalence, intensity, and abundance used here follow the definitions given by Bush et al. (1997). Because the tissues examined for parasites differed among birds, the prevalence for each species of helminth was determined by dividing the number of birds infected with a given helminth by the number of birds in which the

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Table 1. Parasitic helminths reported from great egrets (*Ardea albus*). Species in bold and marked by • were collected from great egrets in the present study.

Helminth	Geographic location	Source
Trematoda		
• <i>Posthodiplostomum minimum</i> (MacCallum, 1921)	Mexico	Ponce de León, 1995
<i>Posthodiplostomum nanum</i> Dubois, 1937	Argentina	Boero et al., 1972
<i>Ascocotyle (Phagicola) angrense</i> Travassos, 1916	Louisiana, U.S.A. Argentina	Sogandares-Bernal and Lumsden, 1963 Boero et al., 1972
• <i>Ascocotyle (Phagicola) diminuta</i> Stunkard and Haviland, 1924	Mexico	Scholz et al., 1997a
<i>Ascocotyle chandleri</i> Lumsden, 1963*	Texas, U.S.A.	Lumsden, 1963
<i>Ascocotyle (Phagicola) longa</i> Ransom, 1920	Florida, U.S.A.	Hutton and Sogandares-Bernal, 1960
<i>Ascocotyle megaloccephala</i> Price, 1932	Mexico	Scholz et al., 1997a
• <i>Ascocotyle (Phagicola) nana</i> Ransom, 1920	Mississippi, U.S.A. Mexico Mexico	Font et al., 1984 Aguirre-Macedo and García-Magaña, 1994 Scholz et al., 1997a
<i>Ascocotyle nunezae</i> Scholz, Vargas-Vásquez, Vidal-Martínez, and Aguirre-Macedo, 1997	Mexico	Scholz et al., 1997b
• <i>Ascocotyle tenuicollis</i> Price, 1935	Mexico	Aguirre-Macedo and García-Magaña, 1994; Salgado-Maldonado et al., 1997; Scholz et al., 1997a
<i>Ascocotyle</i> sp.	Florida, U.S.A.	Hutton, 1964
<i>Apharyngostrigea cornu</i> (Zeder, 1800)	Mississippi, Georgia, Tennessee, U.S.A.	Byrd and Ward, 1943
<i>Apharyngostrigea brasiliana</i> (Szidat, 1928)	Venezuela Argentina	Dubois, 1968 Boero et al., 1972
<i>Strigea pseudibis</i> Odening, 1962†	Germany	Dubois, 1968
• <i>Clinostomum complanatum</i> (Rudolphi, 1814)	Colombia Mexico Venezuela	Rietschel and Werding, 1978 Ramos-Ramos, 1995 Braun, 1899
<i>Clinostomum detruncatum</i> Braun, 1899†	Brazil	Yamaguti, 1971
• <i>Ribeiroia ondatrae</i> (Price, 1931)	Brazil	Freitas, 1948
• <i>Ignavia venusta</i> Freitas, 1948	Brazil	Freitas, 1955
<i>Philophthalmus lacrymosus</i> Braun, 1902	Brazil	Freitas, 1955
<i>Amphimerus interruptus</i> (Braun, 1901)	Mexico	Ramos-Ramos, 1995
<i>Cladocystis trifolium</i> (Braun, 1901)	Mexico	Ramos-Ramos, 1995
Nematoda		
• <i>Contracaecum multipapillatum</i> (Drasche, 1882)	Mexico	Vidal-Martínez et al., 1994
<i>Contracaecum microcephalum</i> (Rudolphi, 1809)	Brazil	Vicente et al., 1995
<i>Porrocaecum reticulatum</i> (Linstow, 1899)	Brazil	Vicente et al., 1995
• <i>Tetrameres</i> sp.	Louisiana, U.S.A.	Mollhagen, 1976
• <i>Eustrongylides ignotus</i> Jägerskiöld, 1909	Delaware, U.S.A. Ohio, U.S.A. Florida, U.S.A. Texas, U.S.A. Louisiana, U.S.A.	Wiese et al., 1977 Cooper et al., 1978 Spalding et al., 1993 Franson and Custer, 1994 Roffe, 1988
<i>Eustrongylides</i> sp.		
Cestoda		
• <i>Cyclusteria ibisae</i> (Schmidt and Bush, 1972)	Cuba	Rysavy and Macko, 1971
<i>Valipora</i> sp.	Cuba	Rysavy and Macko, 1971

* Experimental infection.

† Collected from captive birds.

tissue examined was found to harbor that species of helminth. Representative specimens have been deposited in the U.S. National Parasite Collection, Beltsville, Maryland (USNPC 87691–87727, 82334).

Results and Discussion

The prevalence, mean intensity of infection, abundance, and location of helminths from great egrets are presented in Table 2. At least 1 of 39 species of helminths (21 trematodes, 12 nematodes, 4 cestodes, and 2 acanthocephalans) were collected from 103 of the 106 birds (97%) examined. Infected birds harbored a mean of 6 helminth taxa (range, 1–23). Twenty-eight of these species represent new host records.

Strigeids of the genus *Posthodiplostomum* were the most common trematodes collected in this study, and great egrets were infected with 4 species: *P. opisthocyca*, *P. boydae*, *P. macrocotyle*, and *P. minimum*. Unfortunately, because of their similarity, the latter 2 species could not easily be distinguished, so prevalence, mean intensity, and abundance were combined (Table 2). In Florida, *P. minimum* has been reported from white ibises (*Eudocimus albus*) (Bush and Forrester, 1976) and roseate spoonbills (*Ajaia ajaja*) (Sepúlveda et al., 1994), and *P. macrocotyle* has been reported from little blue herons (*Egretta caerulea*) (Sepúlveda et al., 1996). Fish of the family Centrarchidae (*Lepomis* spp.) are known to be intermediate hosts for *P. minimum* (Palmieri, 1975).

Heterophyids of the genus *Ascocotyle* were found commonly in the small and large intestines of great egrets. This genus was represented by 5 species: *A. diminuta*, *A. mcintoshii*, *A. tenuicollis*, *A. nana*, and *A. gemina*. Except for the last species, all are known from great egrets (Table 1). Sepúlveda et al. (1996) reported a similar complex of heterophyid trematodes for little blue herons from southern Florida. There are several reports on the life cycles of heterophyid parasites in Florida. Metacercariae of *A. nana* develop in the centrarchiids *Micropterus salmoides*, *Lepomis microlophus*, *L. macrochirus*, and *L. humilis* (Font et al., 1984), and those of *A. diminuta*, *A. mcintoshii*, and *A. tenuicollis* have been reported from mosquitofish (*Gambusia affinis*) (Leigh, 1956, 1974; Stein, 1978).

Great egrets were infected with 3 species of echinostomes: *Mesorchis denticulatus* (= *Stephanoprora denticulata*), *Echinochasmus dietzevi*, and *Microparyphium facetum*. These trem-

atodes have been reported in Florida from seabirds and long-legged wading birds (Hutton and Sogandares-Bernal, 1960; Kinsella, 1972; Courtney and Forrester, 1974; Bush and Forrester, 1976; Sepúlveda et al., 1994).

Oral flukes, *Clinostomum* spp., are commonly found in different species of fish-eating birds in Florida (Bush and Forrester, 1976; Threlfall, 1982; Sepúlveda et al., 1994, 1996) and were collected also from great egrets in the present study. Kidney flukes were represented by *Ignavia venusta* and *Renicola* sp. The former species was originally described from great egrets from Brazil (Freitas, 1948) and represents the first record of the species in North America. Specimens of *Renicola* sp. were collected from only 1 bird and only immature parasites were recovered, suggesting that great egrets are probably not a normal definitive host for this parasite.

The pancreatic fluke, *Diasiella diasi*, was originally described from anhingas (*Anhinga anhinga*) in Brazil by Travassos (1922) and has been reported from the osprey (*Pandion haliaetus*) and bald eagle (*Haliaeetus leucocephalus*) in Virginia and the great blue heron (*Ardea herodias*) in Florida (Kinsella et al., 1996). In the present study, the prevalence of this parasite was probably underestimated because the pancreas was examined in only 24 of the 106 egrets.

Contracaecum sp. adults and larvae were the most common nematodes encountered during this study, and because all males found were *C. multipapillatum*, this species was assumed to be the only one present. In Florida, this species of *Contracaecum* has been collected from ciconiiforms and pelecaniforms as definitive hosts (Courtney and Forrester, 1974; Threlfall, 1982; Conti et al., 1986; Sepúlveda et al., 1994, 1996) and from freshwater fishes (families Centrarchidae, Cyprinidae, Poeciliidae, and Cichlidae) as second intermediate hosts (Huizinga, 1967; Vidal-Martínez et al., 1994).

Tetramerid nematodes were also commonly found in this study. Great egrets were infected with a mixture of *Tetrameres microspinosa* and an undescribed species (*Tetrameres* sp.). Mature females were found embedded in the glandular tissue of the stomach, and in extreme cases of parasitism (close to 500 females were collected from 1 bird) the mucosa had a mottled appearance, covered with purple-red cystlike lesions that resembled hematomas. Each of these cysts contained female *Tetrameres* sp. Because of fe-

Table 2. Parasitic helminths of 106 great egrets (*Ardea albus*) from Florida.

Helminth	Lo- cation	USNPC no.	Sample size†	Preva- lence	Intensity		Mean abun- dance
					Mean	Range	
Trematoda							
<i>Posthodiplostomum</i> spp.§§	3	87691, 87692	70	66	556	1–16,000	367
<i>Posthodiplostomum opisthoscicya</i> Dubois, 1969	3	87693	70	43	318	1–1,260	137
<i>Posthodiplostomum boydae</i> Dubois, 1969§	3	87694	70	10	79	1–270	8
<i>Ascocotyle tenuicollis</i> Price, 1935	4	87695	68	54	112	1–1,140	60
<i>Ascocotyle (Phagicola) diminuta</i> Stunkard and Haviland, 1924	3	87696	70	33	64	1–3,580	21
<i>Ascocotyle gemina</i> Font, Overstreet, and Heard, 1984§	4	87697	68	26	44	1–260	11
<i>Ascocotyle mcintoshi</i> Price, 1936§	3	87698	70	6	7	1–9	<1
<i>Ascocotyle (Phagicola) nana</i> Ransom, 1920	3	87699	70	40	171	2–1,360	68
<i>Apharyngostrigea pipientis</i> (Faust, 1918)§	3	87700	70	41	26	1–240	11
<i>Echinochasmus dietzevi</i> Issaitschkoff, 1927§	3	87701	70	30	107	1–520	32
<i>Clinostomum complanatum</i> (Rudolphi, 1814)§	1	87702	73	30	4	1–35	1
<i>Clinostomum attenuatum</i> Cort, 1913	1	87703	73	18	6	1–36	1
<i>Microparyphium facetum</i> Dietz, 1909§	5	87704	68	26	7	1–47	2
<i>Diplostomum ardeae</i> Dubois, 1969§	3	87705	70	16	27	1–240	4
<i>Mesorchis denticulatus</i> (= <i>Stephanoprora denticulata</i>) (Rudolphi, 1802)§	3	87706	70	13	4	1–10	<1
<i>Ribeiroia ondatrae</i> (Price, 1931)§	2	87707	103	9	7	1–17	<1
<i>Pholeter anterouterus</i> Fischthal and Nasir, 1974§	3	87708	70	9	13	1–40	1
<i>Ignavia venusta</i> Freitas, 1948	6	87709	47	6	3	1–4	<1
<i>Diasiella diasi</i> (Travassos, 1922)§	7	87710	24	4	5		<1
<i>Renicola</i> sp.§	6	87711	47	2	24		<1
Nematoda							
<i>Contracaecum multipapillatum</i> (Drasche, 1882)	1, 2	87712	103	77	37	1–203	28
<i>Tetrameres</i> spp.§	2	87713	103	38	70	1–871	27
<i>Eustrongylides ignotus</i> Jägerskiöld, 1909	2	82334	103	38	3	1–10	1
<i>Desmidocercella numidica</i> Seurat, 1920§	3, 9	87714	70	21	74	1–660	16
<i>Capillaria herodiae</i> Boyd, 1966§	3	87715	70	21	7	1–21	1
<i>Desportesius trianuchae</i> (Wright, 1879)§	2	87716	103	9	26	1–131	2
<i>Desportesius invaginatus</i> (Linstow, 1901)§	2	87717	103	6	2	1–5	<1
<i>Desportesius</i> larvae	2		103	9	1	1–60	<1
<i>Avioserpens galliardi</i> Chabaud and Campana, 1949§	1, 8	87718	63	4	1	1–2	<1

Table 2. Continued.

Helminth	Lo- cation	USNPC no.	Sample size†	Preva- lence	Intensity		Mean abun- dance
					Mean	Range	
<i>Acuaria multispinosa</i> Perez Vigueras, 1938§	2	87719	103	2	4	1–6	<1
<i>Chandleronema longigutterata</i> (Chandler, 1942)§	2	87720	103	1	2		<1
<i>Cosmocephalus obvelatus</i> (Creplin, 1825)§	1	87721	73	1	2		<1
Cestoda							
<i>Glossocercus caribaensis</i> (Rysavy and Macko, 1971)§	3	87722	70	7	7	1–26	<1
<i>Dendrouterina ardeae</i> (Rausch, 1955)§	3	87723	70	7	2	1–3	<1
<i>Cyclusteria ibisae</i> (Schmidt and Bush, 1972)	3	87724	70	1	1		<1
Plerocercoid§#	10	87725					
Acanthocephala							
<i>Polymorphus brevis</i> (Van Cleave, 1916)§	3	87726	70	39	22	1–180	9
<i>Arhymorhynchus punilirostris</i> Van Cleave, 1916§	3	87727	70	11	5	1–13	<1

* Location in host: 1 = oral cavity/esophagus; 2 = proventriculus/ventriculus; 3 = small intestine; 4 = large intestine; 5 = cloaca; 6 = kidneys; 7 = pancreas; 8 = lungs; 9 = coelomic cavity; 10 = subcutaneous tissue.

† Number of organs examined differed among birds.

‡ A complex of two species: *P. macrocotyle* Dubois, 1937 (USNPC No. 87692) and *P. minimum* (MacCallum, 1921) (USNPC No. 87691).

§ New host record.

|| A complex of two species: *T. microspinosus* and *Tetraneres* sp.

Because subcutaneous tissue was not regularly checked for the presence of parasites, the prevalence, mean intensity, and abundance of infection were not calculated for this parasite.

males embedded the number of nematodes present could have been underestimated and could explain why only males were usually recovered.

In the great egret, acuariid nematodes were represented by 5 species: *Desportesius trianucha*, *D. invaginatus*, *Acuaria multispinosa*, *Chandleronema longigutterata*, and *Cosmocephalus obvelatus*. The latter 3 species were uncommon, suggesting that great egrets are probably not the normal definitive host. Although acuariids of the genus *Desportesius* were recovered at higher prevalences, in 9 birds only larval stages were found, and thus identification to species was not possible.

The nematode *Desmidocercella numidica* has been reported from the air sacs of several ciconiiform birds (Anderson, 1959; Conti et al., 1986). In the present study, this species was found in the gastrointestinal tract (mainly small intestine, but also stomach, large intestine, and cloaca), coelomic cavity, kidneys, lungs, trachea, and liver. The occurrence of this nematode

in so many different organs, including the body cavity, might have been a technique artifact; the worms may actually have been in the air sacs and may have contaminated the surfaces of different organs during the process of parasite recovery.

Acanthocephalans and cestodes were represented by 2 and 4 species, respectively. The present study constitutes the first report of acanthocephalans in great egrets. *Cyclusteria ibisae* (= *Parvitaenia heardi*) was the most common cestode found. This parasite was originally described from several species of fish-eating birds, including great egrets, from Cuba (Rysavy and Macko, 1971), and in Florida it has been reported from brown pelicans (*Pelecanus occidentalis*) (Courtney and Forrester, 1974) and reddish egrets (*Egretta rufescens*) (Conti et al., 1986). One bird harbored 2 immature cestodes (plerocercoids) in the subcutaneous tissue. Because plerocercoid stages are found in the life cycles of all pseudophyllidean cestodes and consider-

ing that the pseudophyllidean *Spirometra mansonii* is a common parasite of several carnivores in Florida (Forrester, 1992), the immature tape-worm stages found in great egrets may belong to this species. To our knowledge, this is the first report of plerocercoids in an avian host.

Although the main purpose of this study was not to evaluate the pathological effects of helminths on their hosts, some conclusions can be made in this respect. With the exception of infections with some species of trematodes (*Posthodiplostomum* spp., *Ascocotyle* spp., and *E. dietzevi*) and nematodes (*C. multipapillatum*, *Tetrameres* spp., and *Eustrongylides ignotus*), great egrets had relatively low intensities of parasites and their presence was not associated with significant lesions. Infections with the nematode *E. ignotus* have been implicated as an important cause of mortality in great egret nestlings from Ohio (Cooper et al., 1978), Delaware (Wiese et al., 1977), Florida (Spalding et al., 1993), and Texas (Franson and Custer, 1994).

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Literature Cited

- Aguirre-Macedo, M. L., and L. García-Magaña. 1994. Metacercarias de ciclidos nativos del sureste de México: taxonomía y claves para su reconocimiento. *Universidad y Ciencia* 11:5–35.
- American Ornithologists' Union. 1983. Check-list of North American Birds, 6th ed. American Ornithologists' Union, Lawrence, Kansas 877 pp.
- Anderson, R. C. 1959. The egg and first-stage larva of *Desmiodocerca numidica* (Seurat, 1920) with remarks on the affinities of the Desmiodocercidae. *Canadian Journal of Zoology* 37:408–413.
- Boero, J. J., J. E. Led, and E. Brandetti. 1972. El parasitismo de la fauna autóctona. *Revista de Agronomía y de Veterinaria* 1:17–24.
- Braun, M. 1899. Über *Clinostomum* Leidy. *Zoologischer Anzeiger* 22:465–468.
- Bush, A. O., and D. J. Forrester. 1976. Helminths of the white ibis in Florida. *Proceedings of the Helminthological Society of Washington* 43:17–23.
- , K. D. Lafferty, J. M. Lotz, and A. W. Shostak. 1997. Parasitology meets ecology on its own terms: Margolis et al. revisited. *Journal of Parasitology* 83:575–583.
- Byrd, E. E., and J. W. Ward. 1943. Notes on the genital system of the bird fluke, *Apharyngostrigea cornu* (Zeder). *Journal of Parasitology* 29:270–274.
- Conti, J. A., D. J. Forrester, and R. T. Paul. 1986. Parasites and diseases of reddish egrets (*Egretta rufescens*) from Texas and Florida. *Transactions of the American Microscopical Society* 105:79–82.
- Cooper, C. L., J. L. Crites, and J. S. Fastzkie. 1978. Experimental and natural infections of *Eustrongylides* sp. (Nematoda: Dioctophymatidae) in waterfowl and shore birds. *Avian Diseases* 22:790–792.
- Courtney, C. H., and D. J. Forrester. 1974. Helminth parasites of the brown pelican in Florida and Louisiana. *Proceedings of the Helminthological Society of Washington* 41:89–93.
- Dubois, G. 1968. Du statut de quelques Strigeata La Rue, 1926. III. *Bulletin de la Société Neuchâteloise des Sciences Naturelles* 91:5–19.
- Font, W. F., R. M. Overstreet, and R. W. Heard. 1984. Taxonomy and biology of *Phagicola nana* (Digenea: Heterophyidae). *Transactions of the American Microscopical Society* 103:408–422.
- Forrester, D. J. 1992. *Parasites and Diseases of Wild Mammals in Florida*. University Press of Florida, Gainesville. 459 pp.
- Franson, J. C., and T. W. Custer. 1994. Prevalence of eustrongylidosis in wading birds from colonies in California, Texas, and Rhode Island, USA. *Colonial Waterbirds* 17:168–172.
- Frederick, P. C., M. G. Spalding, M. S. Sepúlveda, G. Williams, S. Bouton, H. Lynch, J. Arrecis, S. Loerzel, and D. Hoffman. 1997. Effects of environmental mercury exposure on reproduction, health and survival of wading birds in the Florida Everglades. Florida Department of Environmental Protection, Tallahassee, and the U.S. Fish and Wildlife Service, Atlanta, Georgia. 126 pp.
- Freitas, J. F. 1948. Echinostomatidae parasito de uretér de ave (Trematoda). *Revista Brasileira de Biologia* 8:489–492.
- . 1955. Sobre dois trematodeos de aves: *Philophthalmus lachrymosus* Braun, 1902 e *Renicola mirandaribeiroi* n.sp. *Arquivos do Museu Nacional, Rio de Janeiro* 42:585–610.
- Huizinga, H. W. 1967. The life cycle of *Contracaecum multipapillatum* (Von Drasche, 1882) Lucker, 1941 (Nematoda: Heterocheilidae). *Journal of Parasitology* 53:368–375.
- Hutton, R. F. 1964. A second list of parasites from marine and coastal animals of Florida. *Transactions of the American Microscopical Society* 83:439–447.
- , and F. Sogandares-Bernal. 1960. Studies on helminth parasites from the coast of Florida. II. Digenetic trematodes from shore birds of the west

- coast of Florida. 1. Bulletin of Marine Science of the Gulf and Caribbean 10:40–54.
- Kinsella, J. M.** 1972. Helminth parasites of the black skimmer, *Rynchops nigra*, from Lake Okeechobee, Florida. Journal of Parasitology 58:780.
- , **R. A. Cole, D. J. Forrester, and C. L. Rod-erick.** 1996. Helminth parasites of the osprey, *Pandion haliaetus*, in North America. Journal of the Helminthological Society of Washington 63:262–265.
- , and **D. J. Forrester.** 1972. Helminths of the Florida duck, *Anas platyrhynchos fulviquila*. Proceedings of the Helminthological Society of Washington 39:173–176.
- Leigh, W. H.** 1956. Studies on larval trematodes of fresh water and marine molluscs of South Florida with special reference to the causative agents of seabather's eruption. Report No. 3 to the National Institutes of Health, Public Health Service. Department of Zoology, University of Miami, Coral Gables, Florida. 7 pp.
- . 1974. Life history of *Ascocotyle mcintoshii* Price, 1936 (Trematoda: Heterophyidae). Journal of Parasitology 60:768–772.
- Lincoln, F. C.** 1939. The Migration of American Birds. Doubleday, Doran, and Company, New York. 189 pp.
- Lumsden, R. D.** 1963. A new heterophyid trematode of the *Ascocotyle* complex of species encysted in poeciliid and cyprinodont fishes of southeast Texas. Proceedings of the Helminthological Society of Washington 30:293–296.
- Mollhagen, T. R.** 1976. A study of the systematics and hosts of the parasitic nematode genus *Tetrameres* (Habronematodea: Tetrameridae). Ph.D. Thesis, Texas Tech University, Lubbock. 546 pp.
- Palmieri, J. R.** 1975. Physiological strains of the strigeoid trematode, *Posthodiplostomum minimum* (Trematoda: Diplostomatidae). Journal of Parasitology 61:1107.
- Ponce de León, G. P.** 1995. Host-induced morphological variability in adult *Posthodiplostomum minimum* (Digenea: Neoplostomidae). Journal of Parasitology 81:818–820.
- Ramos-Ramos, P.** 1995. Algunos tremátodos de vertebrados de la presa Miguel Alemán en Temascal, Oaxaca, México. Anales del Instituto de Biología, Universidad Nacional Autónoma de México, Serie Zoológica 66:241–246.
- Rietschel, G., and B. Werding.** 1978. Trematodes of birds from northern Colombia. Zeitschrift für Parasitenkunde 57:57–82.
- Roffe, T. J.** 1988. *Eustrongylides* sp. epizootic in young common egrets (*Casmerodius albus*). Avian Diseases 32:143–147.
- Rysavy, B., and J. K. Macko.** 1971. Bird cestodes of Cuba. 1. Cestodes of birds of the orders Podicipediformes, Pelecaniformes, and Ciconiiformes. Anales del Instituto de Biología, Universidad Autónoma de México, Serie Zoológica 42:1–28.
- Salgado-Maldonado, G., R. Pineda-López, V. M. Vidal-Martínez, and C. R. Kennedy.** 1997. A checklist of metazoan parasites of cichlid fish from Mexico. Journal of the Helminthological Society of Washington 64:195–207.
- Sepúlveda, M. S., M. G. Spalding, J. M. Kinsella, R. D. Bjork, and G. S. McLaughlin.** 1994. Helminths of the roseate spoonbill, *Ajaia ajaja*, in southern Florida. Journal of the Helminthological Society of Washington 61:179–189.
- , ———, ———, and **D. J. Forrester.** 1996. Parasitic helminths of the little blue heron, *Egretta caerulea*, in southern Florida. Journal of the Helminthological Society of Washington 63:136–140.
- Scholz, T., J. Vargas-Vásquez, L. Aguirre-Macedo, and V. M. Vidal-Martínez.** 1997a. Species of *Ascocotyle* Looss, 1899 (Digenea: Heterophyidae) of the Yucatan Peninsula, Mexico, and notes on their life-cycles. Systematic Parasitology 36:161–181.
- , ———, **V. M. Vidal-Martínez, and L. Aguirre-Macedo.** 1997b. *Ascocotyle* (A.) *nunezae* n. sp. (Digenea: Heterophyidae) from Yucatan, Mexico. Journal of Parasitology 83:141–147.
- Sogandares-Bernal, F., and R. D. Lumsden.** 1963. The generic status of the heterophyid trematodes of the *Ascocotyle* complex, including notes on the systematics and biology of *Ascocotyle angrense* Travassos, 1916. Journal of Parasitology 49:264–274.
- Spalding, M. G., G. T. Bancroft, and D. J. Forrester.** 1993. The epizootiology of eustrongylidosis in wading birds (Ciconiiformes) in Florida. Journal of Wildlife Diseases 29:237–249.
- Stein, P. C.** 1978. New intermediate fish hosts for the heterophyid trematodes *Ascocotyle pachycystis*, *Ascocotyle ampullacea*, and *Phagicola macrostomus*. Journal of Parasitology 54:631.
- Threlfall, W.** 1982. Endoparasites of the double-crested cormorant (*Phalacrocorax auritus*) in Florida. Proceedings of the Helminthological Society of Washington 52:297–310.
- Travassos, L.** 1922. Informações sobre a fauna helminthologica de Matto Grosso. Folha Medica, Rio de Janeiro 3:187–190.
- Vicente, J. J., R. Magalhaes-Pinto, D. Noronha, and L. Gonçalves.** 1995. Nematode parasites of Brazilian Ciconiiformes birds: a general survey with new records for the species. Memórias do Instituto Oswaldo Cruz 90:389–393.
- Vidal-Martínez, V. M., D. Osorio-Sarabia, and R. M. Overstreet.** 1994. Experimental infection of *Contracaecum multipapillatum* (Nematoda: Anisakinae) from Mexico in the domestic cat. Journal of Parasitology 80:576–579.
- Wiese, J. H., W. R. Davidson, and V. F. Nettles.** 1977. Large scale mortality of nestling ardeids caused by nematode infection. Journal of Wildlife Diseases 13:376–382.
- Yamaguti, S.** 1971. Synopsis of Digenetic Trematodes of Vertebrates. Vols. I and II. Keigaku Publishing, Tokyo. 1,750 pp.